Advance Engineering Mathematics(AEM)

Branch :Information Technology, Sem:IIIrd

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Vision of the Institute

To become a renowned centre of outcome based learning, and work towards academic, professional, cultural and social enrichment of the lives of individuals and communities

Mission of the Institute

- Focus on evaluation of learning outcomes and motivate students to inculcate research aptitude by project based learning.
- Identify, based on informed perception of Indian, regional and global needs, the areas of focus and provide platform to gain knowledge and solutions.
- Offer opportunities for interaction between academia and industry.
- Develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders may emerge.

Course Outcomes

- **CO2:** To learn the formulation of different mathematical problems into optimization problems.
- **CO3:** Apply the principles of optimization using differential calculus.
- **CO4:** To understand the concepts of Linear Programming
- **CO1:** To learn the concepts and principles of Random variables and Probability distribution.

Simplex Method

Problems 5.

Max $Z = 3X_1 + 5X_2 + 4X_3$

Sub to

$2x_1 + 3x_2 \leq 8$

$2x_2 + 5x_3 \leq 10$

$3x_1 + 2x_2 + 4x_3 \leq 15$

$x_1, x_2, x_3 \geq 0$

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Sol: By introducing the slack variable the problem becomes:

Max Z=

$$3x_1 - x_2 + 3x_3 + x_4 = 7$$

$$-2x_1 + 4x_2 + x_5 = 12$$

$$-4x_1 + 3x_2 + 8x_3 + x_{6=} 10$$

$$x_1, x_2, x_3, x_4, x_5 \geq 0$$

Table – 1

		C_j	-1	3	-2	0	0	0	
C_B	Basic Variables	X_B	X_1	X_2	X_3	S_1	S_2	S_3	Mini Ratio= X_B/X_i
0	S1	7	3	-1	3	1	0	0	Neg-
0	S2	12	-2	4	0	0	1	0	12/4= 3→
0	S3	10	-4	3	8	0	0	1	10/3
	$\Delta i=C_BX_B - C_j$		**$\Delta_1=1$**	**$\Delta_2=-3$**	**$\Delta_3=2$**	**$\Delta_4=0$**	**$\Delta_5=0$**	**$\Delta_6=0$**	
				↑			↓		
				Incoming			Outgoing		

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Table – 2

		C_j	1	-1	3	0	0	0	
C_B	Basic Variable	X_B	X_1	X_2	X_3	S_1	S_2	S_3	Mini Ratio
0	S1	10	5/2	0	3	1	1/4	0	10*2/5 →
3	X2	3	-1/2	1	0	0	1/4	0	-
0	S3	1	-5/2	0	8	0	-3/4	1	-
			Δ_1=-1/2	**Δ_2= 0**	**Δ3=2**	**Δ_4=0**	**Δ_5= 3/4**		
			↑			↓			
			Incoming vector			Outgoing vector			

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Table – 3

		C_j	1	-1	3	0	0	0	
C_B	BasicVariable	X_B	X_1	X_2	X_3	S_1	S_2	S_3	Mini Ratio
1	X_1	4	1	0	6/5	2/5	1/10	0	10 *2 /5 →
3	X_2	5	0	1	3/5	1/5	6/10	0	-
0	S_3	11	0	0	11	1	-1/2	1	-
			$\Delta_1=0$	**$\Delta_2=0$**	**$\Delta_3=13/5$**	**$\Delta_4=3/5$**	**$\Delta_5=16/20$**		
			↑			↓			
			Incoming vector			Outgoing vector			

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Max. Z =11

Thus, Min Z = -11

$x_1 = 4, x_2 = 5$

Problems 4.

Max $Z = 3X_1 + 2X_2 + 5X_3$

Sub to

$$x_1 + x_2 + x_3 \leq 9$$

$$2x_1 + 3x_2 + 5x_3 \leq 30$$

$$2x_1 - x_2 - x_3 \leq 8$$

$$x_1, x_2, x_3 \geq 0$$

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Table – 1

		C_j	3	2	5	0	0	0	
C_B	Basic Variables	X_B	X_1	X_2	X_3	S_1	S_2	S_3	Mini Ratio= X_B/X_i
0	S1	9	1	1	1	1	0	0	9/1=9
0	S2	30	2	3	5	0	1	0	30/5= 6→
0	S3	8	2	-1	-1	0	0	1	-
	$\Delta_i=C_BX_B - C_j$		**$\Delta_1=-3$**	**$\Delta_2=-2$**	**$\Delta_3=-5$**	**$\Delta_4=0$**	**$\Delta_5=0$**	**$\Delta_6=0$**	
					↑		↓		
					Incoming		Outgoing		

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Table – 2

		C_j	1	-1	3	0	0	0	
C_B	BasicVariable	X_B	X_1	X_2	X_3	S_1	S_2	S_3	Mini Ratio
0	S_1	3	3/5	2/5	0	1	-1/5	0	3*5/3=5 →
3	X_3	6	2/5	3/5	1	0	1/5	0	6*5/2=15
0	S_3	14	12/5	-2/5	0	0	1/5	1	14*5/12=35/6
			Δ_1=-1	**Δ_2=1**	**Δ_3=0**	**Δ_4=0**	**Δ_5=1**	**Δ_6=0**	
			↑			↓			
			Incoming vector			Outgoing vector			

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Table – 3

		C_j	1	-1	3	0	0	0	
C_B	BasicVariable	X_B	X_1	X_2	X_3	S_1	S_2	S_3	
3	X_1	5	1	2/3	0	5/3	-1/3	0	
5	X_2	4	0	1/3	1	-2/3	1/3	0	
0	S_3	2	0	-2	0	-4	1	1	
			$\Delta_1=0$	**$\Delta_2=5/3$**	**$\Delta_3=0$**	**$\Delta_4=5/3$**	**$\Delta_5=2/3$**	**$\Delta_6=0$**	

Thus the optimal solution is **Z= 35**

$$x_1=5, x_2=0, x_3=4$$

Solve:

Solve the Simplex method

$$\text{Max } z = 3x_1+5x_2+4x_3$$

$$\text{Sub to } \quad 2x_1+3x_2 \leq 8$$

$$2x_1+5x_3 \leq 10$$

$$3x_1+2x_2+4x_3 \leq 15$$

$$x_1, x_2, x_3 \geq 0$$

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Reference:

- https://www.slideshare.net/sachin.mk/simplex-method
- Engineering Mathematics III CS/IT Engineering

Vardhan Publication

Thank You

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